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(54) **Braided guide wire and method for the use thereof.**

(57) An improved guide wire which is steerable, (i.e., torquable without whipping) at lengths of up to approximately 13 ft. while still being flexible enough to negotiate anatomical bends. Also a method of utilizing such guide wire in conjunction with the viewing properties of an endoscope to reach certain gastrointestinal sites, thereby permitting selected medical procedures to be performed.

More particularly, the improved guide wire of this invention has a solid metal core wire with a tapered distal end and a braided mesh applied under tension over the core wire along its entire length. The mesh may be attached to core wire at one or more selected points along the wire, and a coating of a low lubricity material may be applied to the outside of the mesh.

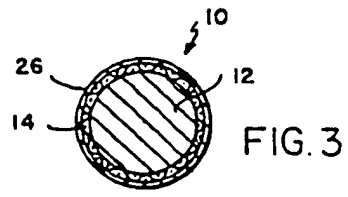

FIG. 3

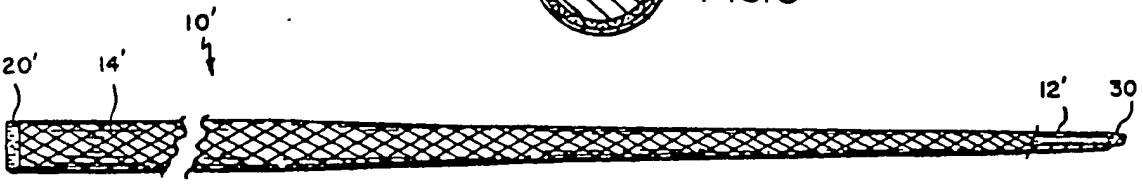

FIG.4

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vid suitabl results. The picks-per-inch will control the tent angle. This wire might have its diameter ground to 0.015 inches over a 6 inch section 16 and taper to a 0.006 inch diameter over a final 4 inch section 18. The nature of the braiding process is such that the braided wire mesh will always conform to the configuration of the core wire, including, as shown, any tapers in the core wire. If a urethane coating is applied to the wire, the resulting wire may be too stiff with 58.7 picks-per-inch and it may be necessary to reduce the number of picks-per-inch to achieve a desired stiffness. Since the braiding 14 as applied to core wire 12 is symmetric, the steerability of the guide wire 10 is the same regardless of the directions in which it is being torqued.

In order to further secure the braiding 14 to core wire 12, the braiding may be attached to the core wire at suitable points by a suitable means. The preferred means for securing the braiding to the core wire is by brazing. Although soldering, gluing or other means might be employed, these means are not preferred since soldering does not take a coating as well as brazing and gluing is considered to be a slower and generally less effective procedure. In FIG. 1, a braze joint 20 is shown at the proximal end of the guide wire, a braze joint 22 at the distal end, and three braze joints 24 at points along the wire. The exact location of the brazejoints 24 is not critical, nor is their spacing. In one embodiment of the invention, the braze joints 24 are approximately 1/3 of the way along the wire from the proximal end and the distance from end to end of the braze joints is approximately 3 inches.

Since the guide wire is to pass through body channels, a catheter, an endoscope channel, or other channels, it is desirable that the wire be coated with a low lubricity coating 26. Since this coating is very thin, it is not easily visible but is shown in FIGS. 1 and 3 of exaggerated width so as to be visible. The coating is preferably a sprayed-on Teflon coating but may also be a coating of a thermoset urethane which may be dipped and/or sprayed on. The coating could also be formed from a continuous sleeve of lubricious material such as Teflon that is formed into a heat shrunk tube that is threaded over the wire. Application of heat causes the Teflon tube or sleeve to shrink and bind itself firmly into the woven braiding 14. As was indicated above, since the coating may affect the stiffness of the guide wire, it will need to be taken into account in selecting various other parameters such as picks-per-inch. However, the coating does not appear to have any noticeable affect on the steerability of the wire.

FIG. 4 illustrate an alternative embodiment of the invention wherein the core wire 12' tapers uniformly at its distal end 28 rather than in sections. For this embodiment f this invention, only a single braze joint 20' is provided at the proximal end of the wire. At the distal end, the braiding 14' extends beyond the end of core wire 12' and the portion 30 of the braiding extending beyond the end of the core wire is brazed or otherwise secured together to form a soft, slightly flexible tip for the guide wire. This is useful in permitting the wire to get around bends, particularly anatomical bends, and to avoid abrasion or other injury to the walls of such anatomical channels.

While for the guide wire embodiments described above, the braiding is uniform along the entire length of the wire, it may be desirable in some applications to, for example, reduce the picks-per-inch or otherwise change the braiding near the distal end of the wire to reduce stiffness in this area.

FIG. 5 is a diagram illustrating how the guide wire of this invention might be utilized in conjunction with an endoscope 50 to permit certain gastrointestinal medical procedures to be performed.

The endoscope 50 is positioned through the mouth 52 and esophagus 54 of the patient and through the patient's stomach until the distal end of the endoscope is adjacent to the patient's bile duct 56. A side viewing channel 57, containing for example a fiber optic bundle, is provided in endoscope 50 through which medical personnel may view the progress of the endoscope and which may be utilized to permit the distal end of the endoscope to be properly positioned. A light guide channel is also typically provided in an endoscope to facilitate viewing. A guide wire 58, which may for example be a guide wire of the types described above in conjunction with FIGS. 1-4, is then passed through an open channel 60 in the endoscope and out an opening 62 in the endoscope's distal side. Using optical channel 57, the medical personnel may then position the guide wire 58 in the bile duct 56 and advance the wire through the bile duct to a desired body site. Since guide wire 58 is thick enough to be radiopaque, standard X-ray techniques may be used to view the progress of the guide wire through the bile duct and to advance the guide wire to a desired site. For example, the guide wire may be advanced to or adjacent to the gall bladder 64 or the pancreas 66. Once the guide wire 58 is in the bile duct 56, a catheter 68 may be passed over guide wire 58 into bile duct 56 and used, for example, to pass radiopaque dye into the duct to assist in the advancing of the guide wire to the desired site. This, however, must be done carefully to avoid damage to the pancreas or other organs.

Once the guide wire 58 has been advanced to the desired site, catheter 68 may be advanced over the guide wire to the site. Guide wire 58 may then be removed and either medicinal substances may

be delivered to the site through catheter 68 to, for example, break up gall stones or other medical instruments known in the art, such as a ball on catheter, laser optical device or the like, may be brought to the site either as part of the catheter or through the catheter.

A guide wire has thus been provided which exhibits improved steerability even at substantial lengths while still permitting the guide wire to have adequate flexibility. A method for performing various gastrointernal procedures has also been provided which utilizes a guide wire such as the improved guide wire of this invention in conjunction with an endoscope or similar device to reach and permit treatment at various remote gastrointestinal sites.

While the invention has been described above with reference to preferred embodiments, and various modifications to such embodiments have been discussed, it should be understood that the forgoing and other changes in form and detail may be made thereon by one skilled in the art without departing from the spirit and scope of the invention.

Claims

1. A guide wire comprising:
a solid metal core wire having a tapered distal end; and
a mesh braided under tension over the core wire along its entire length.

2. A guide wire as claimed in claim 1 wherein said braided mesh is formed of thin stainless steel wire.

3. A guide wire as claimed in claim 1 wherein said braided mesh is formed of a combination of high tensile fibers and thin metal wires.

4. A guide wire as claimed in claim 3 wherein the fibers are Dacron fibers and the wires are stainless steel wires.

5. A guide wire as claimed in claim 1 wherein said core wire is formed of stainless steel.

6. A guide wire as claimed in claim 1 including means for attaching the braided mesh to the core wire at at least selected point along the wire.

7. A guide wire as claimed in claim 6 wherein said means for attaching attaches the braided mesh and the core wire at at least the proximal end of the core wire.

8. A guide wire as claimed in claim 7 wherein said means for attaching attaches the braided mesh and the core wire at the ends and at selected intermediate points.

9. A guide wire as claimed in claim 6 wherein said attaching means is operative to braze the mesh and core wire.

10. A guide wire as claimed in claim 6 wherein said attaching m ans includes means for soldering said braided mesh and core wir .

11. A guide wire as claimed in claim 1 wherein said braided mesh extends slightly beyond the distal end of said core wire; and
including means for securing together the sides of the extended mesh portion to form a flexible distal tip for the guide wire.

12. A guidewire as claimed in claim 11 wherein said means for securing includes means for brazing said sides together.

13. A guide wire as claimed in claim 1 including a coating of a low lubricity material applied to the outside of said braided mesh.

14. A guide wire as claimed in claim 13 wherein said coating is a Teflon coating which is sprayed on.

15. A guide wire as claimed in claim 13 wherein said coating is a heat shrink Teflon tube which is heat shrunk into the braided mesh.

16. A guide wire as claimed in claim 1 wherein the braiding of said mesh is performed with a selected braiding tension, a selected tent angle for the material forming said mesh and a selected picks-per-inch for the braiding; and
wherein said braiding tension, tent angle and picks-per-inch are combined for a given guide wire such that the guide wire is capable of transmitting torque without whipping and with the wire not being too stiff to negotiate right angle bends.

17. A guide wire as claimed in claim 16 wherein the picks-per-inch for the braiding is reduced near the distal end to reduce stiffness.

18. A guide wire as claimed in claim 1 wherein the length of said wire is at least 8 ft.

19. A method for positioning a guide wire in a small anatomical duct comprising the steps of:
moving an endoscope through a body channel to a position adjacent to said duct;
advancing a steerable guide wire through a channel in the endoscope and out an opening in the distal end thereof;
viewing the duct through an optical channel in the endoscope; and
utilizing said viewing step to manipulate said wire into said duct.

20. A method as claimed in claim 19 wherein said body channel includes the esophagus, and wherein said duct is a bile duct.

21. A method as claimed in claim 19 including the step of moving a catheter over said guide wire into said duct.

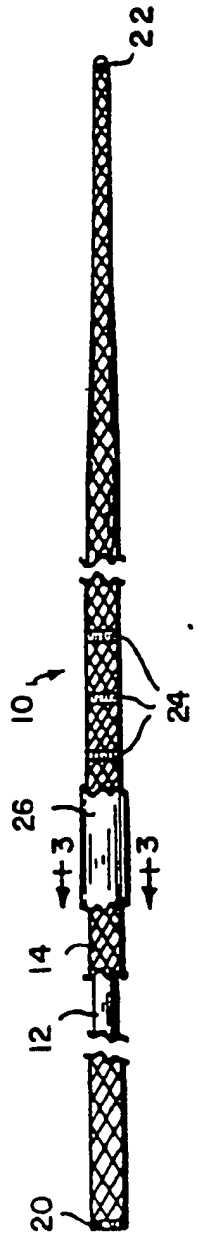

FIG.1

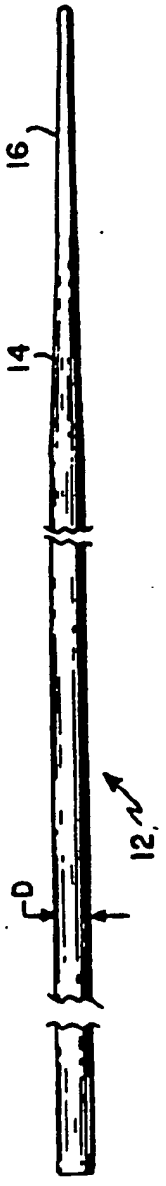

FIG.2

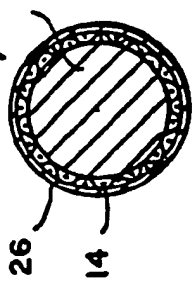

FIG.3

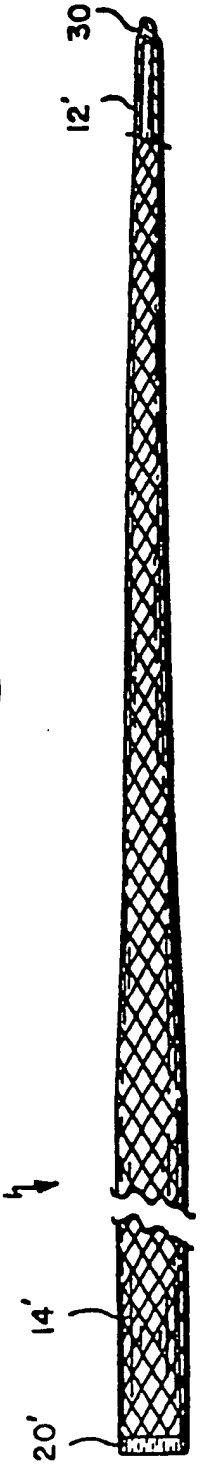

FIG.4

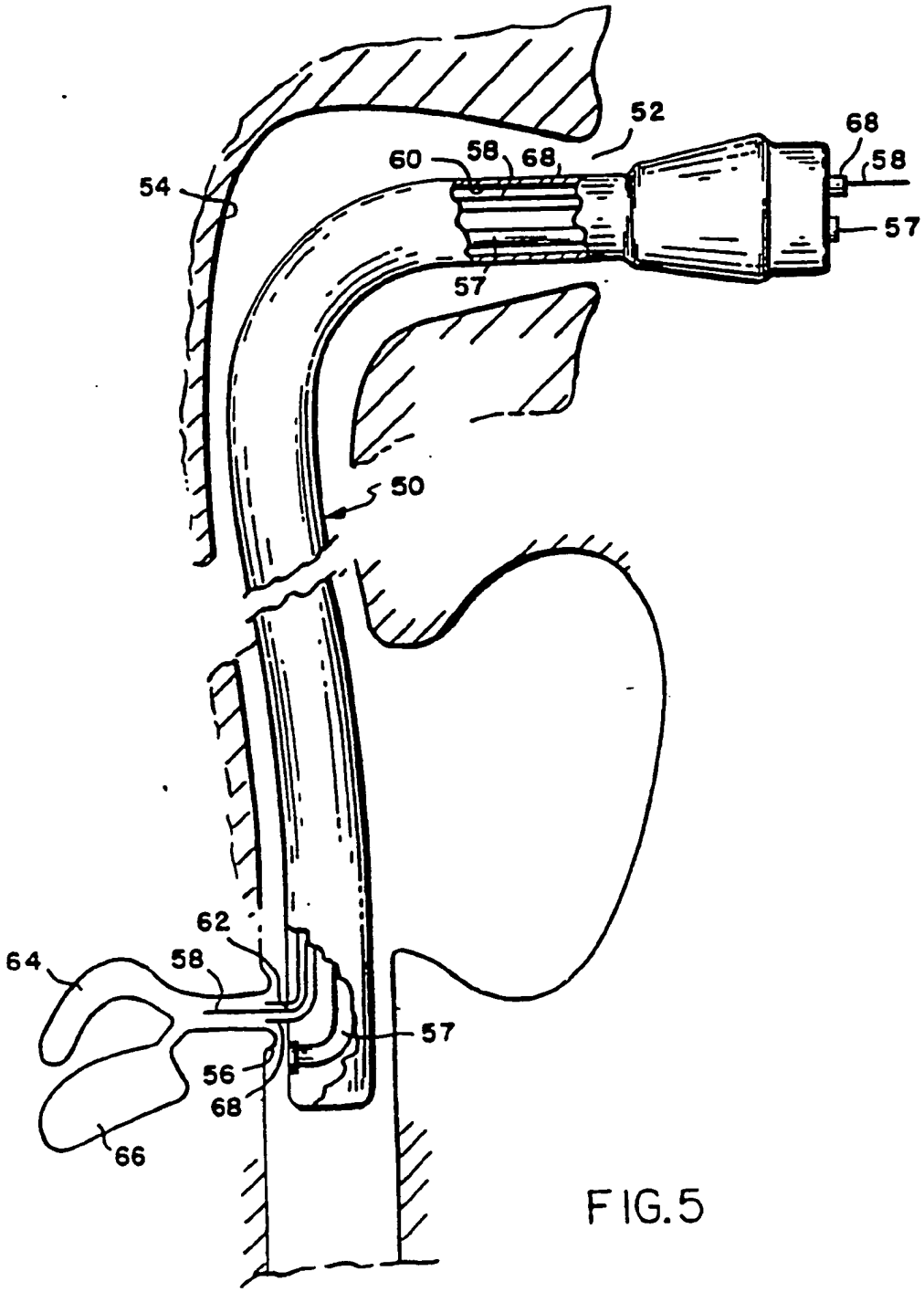

FIG.5

European Patent Office

PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application number

EP 89 31 2619

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	EP-A-0 132 694 (INTERMEDICAT) * Abstract; figures 1,2 * --	1	A 61 M 25/01
A	GB-A-2 017 182 (FRESENIUS) * Abstract; figure 2 * --	1	
A	EP-A-0 200 430 (ADVANCED CARDIO-VASCULAR SYSTEMS) --		
A,D	GB-A-2 127 294 (C.R. BARD INC.) & US-A-4 545 390 ----		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

A 61 M
D 04 C

INCOMPLETE SEARCH

The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely: 1-18

Claims searched incompletely:

Claims not searched: 19-21

Reason for the limitation of the search:

Method for treatment of the human or animal body by surgery or therapy (see Art. 52(4) of the European Patent Convention).

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-05-1990	CLARKSON

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
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& : member of the same patent family, corresponding document

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